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Chapter 1
Introduction

David Meredith

This collection of papers is based on revised versions of presentations made at a day-long Expert Seminar in Music held at Royal Holloway, University of London, on Friday 3 March 2006. This seminar, hosted by Tim Crawford and Andrew Wathey and funded by the AHRC ICT Methods Network, was entitled 'Modern Methods for Musicology: Prospects, Proposals and Realities'. The main purpose of the seminar was to explore the ways in which Information and Communication Technology (ICT) can be used to enhance research, teaching and learning in musicology. Since the Expert Seminar in March 2006, the papers have been revised in the light of discussions, and two further contributions added.

In his introductory address, Tim Crawford explained that, when conceiving the Seminar, he intended the term 'musicology' to be understood to include fields such as music theory, analysis and performance analysis as well as traditional historical musicology. The original intention was to exclude consideration of composition on the grounds that ICT has already been much more extensively and fruitfully applied in this area than it has in other fields of musical study. Nevertheless, some consideration was given to the ways in which ICT can be used in creative music practice (i.e. performance and composition, see Duffy, Chapter 6, this volume). This book, which is the direct result of the expert seminar, therefore provides both a picture of the *realities* of how ICT is currently being used in musicology as well as *prospects* and *proposals* for how it could be fruitfully used in the future.

The chapters that follow cover a diverse range of topics that reflect the breadth and multidisciplinarity of the field. Wiggins focuses on the problem of representing musical knowledge so that it can be effectively processed using computers. Wiering highlights the limitations of traditional book-based critical editions and proposes their replacement with multidimensional digital editions in which relationships between digitized source materials are represented by a network of hyperlinks. Fingerhut and Donin describe software tools developed at IRCAM that can be used to facilitate and enhance musicological study. Howard discusses the various ways in which computers have been used in singing for voice training, analysis and research. Duffy presents a preliminary map of how ICT is currently used within creative music practice. Goebl and Widmer provide an up-to-date overview of computational tools and models for analysing and understanding expressive performance. Lindsay describes an on-going project (now complete) to identify user needs and existing technology for processing time-based audio-visual media. Casey focuses on tools for structural analysis and information retrieval in musical

audio. Finally, Marsden suggests that there is still a wide 'gulf' between those musicologists who use traditional methods and those who use the computer as their chief research tool, and proposes ways in which this gulf might be bridged.

During the seminar in which the present volume originated, there were two extended open discussions that focused in particular on the following four themes:

- The computational representation of musical information and knowledge and, in particular, the dichotomy between symbolic and audio music representations.
- Visualizing musical information and the design of appropriate interfaces for music processing software.
- The need for greater transdisciplinary awareness and collaboration among technologists and musicologists.
- The ways in which the use of ICT is transforming musicological practice and whether this transformation should be sudden or gradual.

These issues also occur time and again in the chapters that follow. I shall therefore now present a reasonably detailed account of the discussions that took place at the Expert Seminar, which, I hope, will provide a more engaging introduction to the chapters that follow than a blow-by-blow summary of the rest of this book. A complete report on the Expert Seminar is available online.[1]

An account of the discussions held at the Expert Seminar

One of the main topics debated in the discussion sessions at the Expert Seminar was the computational representation of musical information and knowledge and, in particular, the dichotomy between symbolic and audio music representations. It was proposed that a clear distinction should be made between the implementational details of how musical data is encoded (e.g. the design of file formats) and the design of representational systems (e.g. abstract data types) that support the logical and mathematical properties of musical materials (see Wiggins, Chapter 2, this volume).

Following on from this discussion, it was also suggested that, in the design of music software systems (or, indeed, *any* software system), the way in which a concept is implemented within a system should be properly hidden from the user and encapsulated within an interface that allows access only to appropriate parts of the implementation. There followed some debate as to whether MusicXML

1 D. Meredith, 'Rapporteur's Report' on AHRC ICT Methods Network Expert Seminar on 'Modern Methods for Musicology: Prospects, Proposals and Realities', Royal Holloway, University of London, 3 March 2006. Available online at <http://www.methodsnetwork.ac.uk/redist/pdf/es2rappreport.pdf>, accessed 21 April 2009.

(<http://www.recordare.com/xml.html>, accessed 21 April 2009) could become a universal format for exchanging musical information. However, the practical viability of the whole notion of a universally accepted music data file format was questioned and it was suggested that any data structure for music should be designed with specific test applications in mind. It was then proposed that probabilistic and machine-learning techniques had to be employed in order to represent properly the multiplicity of models employed by musicians and musicologists (e.g. the various different ways in which key is determined). It was observed that different 'musical surfaces' are required for different applications; a musical surface being a description of a passage at the most detailed level necessary for a particular application. The sonic, notational and perceptual manifestations of a musical work are therefore simply different musical surfaces giving different perspectives on the Platonic, unattainable compositional idea of a musical work (see Wiggins, Chapter 2, this volume).

There was a lively discussion about just how successful, or complete, Western staff notation (CMN) is at representing music. It was pointed out that, for example, the physical 'sound' of a specific performance and the 'intention' of a composer are not well served by CMN, which should only be regarded as one – albeit very useful – choice among an indefinite number of possible musical surfaces. A notated score can provide a convenient common point of reference for performers and musicologists, as can the graphical representations produced by certain analytical techniques such as that of Schenker.[2] However, it may be that musicology has been concerned too much with the explanation of the structures of scores and too little with the active perception and cognition of music. In particular, representational systems should be designed to handle not just notes but also perceptual entities such as voices (or, more generally, streams), chords, phrases (or, more generally, groups) and so on.

The presentations given at the seminar could be neatly divided into those concerned primarily with music at the symbolic level and those focused primarily on sub-symbolic, audio processing. However, ideally we should be able to map seamlessly and transparently between representations at different levels of structure (i.e., between musical sounds, notes and perceptual entities such as groups, streams and chords). Moreover, there no longer seems to be such a clear dichotomy between the symbolic and audio domains, as we are beginning to use similar techniques (e.g. chromagrams) on both types of data.[3]

A second important topic discussed was the design of appropriate interfaces for music processing software and the visualization of musical information. A major difficulty lies in providing technologically-naïve users access to the power of a system when there is complex underlying technology. For example, the

2 H. Schenker, *Free Composition (Der freie Satz)*, ed. and trans. E. Oster (New York: Schirmer, 1979).

3 See, for example, C.L. Krumhansl, *Cognitive Foundations of Musical Pitch* (New York and Oxford: Oxford University Press, 1990); Casey, Chapter 9, this volume.

HUMDRUM tool kit[4] (see <http://www.music-cog.ohio-state.edu/Humdrum/>, accessed 21 April 2009) is undoubtedly a powerful music processing system, but the bare-bones nature of its interface means that it can only be used by those who are familiar with writing UNIX shell scripts – not a skill that one expects of a typical musicologist. A software interface needs to be *graded* so that beginners can easily perform typical, common tasks and gradually become able to perform more complex tasks as they become more familiar with the system.

The third main topic considered was the need for greater transdisciplinary awareness and collaboration among technologists and musicologists. It was observed that there is now a new generation of people who have high-level skills in both music and technology and who are therefore not locked into traditional disciplines. It might therefore only be a matter of time before the problem of interdisciplinarity in our field disappears for good. Concerns were raised over the danger of technologically-naïve (but, possibly, musically sophisticated) users making false conclusions from (or attaching too much significance to) the output generated by analytical software tools. It was suggested that therefore users in the field could no longer be excused for being technologically-naïve. Musicologists must at least be able to frame questions in a way that is comprehensible to a computer scientist so that useful new tools can be developed. Several examples were cited of music practitioners obtaining useful results by misusing software tools. However, in the longer term, it is clear that a certain degree of focused training in particularly relevant technologies should be compulsory within musicological education. It also seems clear that musicology needs to become a less isolated activity and that a new culture of inter- and intradisciplinary collaboration needs to be nurtured within it. This is already being promoted by the research councils who are funding projects that employ both computer scientists and musicologists. However, it was noted that musicians and musicologists still seem to be somewhat under-represented within the Music Information Retrieval (MIR) community.

The final general topic debated during the discussion sessions at the seminar was the ways in which the use of ICT is transforming musicological practice and whether this transformation should be sudden or gradual. The use of computing technology transforms the nature of musicology because it is so different from traditional methods. However, some would argue that, if such change is to be sustainable in the long term, it needs to be effected gradually. Lessons can be learned from the field of text analysis, where computer-based researchers wrote themselves out of their communities by working too far outside traditional methods for their colleagues to be able to make use of their results. Those using traditional techniques need to be able to evaluate the work of those using newer methodologies.

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4 D. Huron, 'Humdrum and Kern: Selective Feature Encoding', in E. Selfridge-Field (ed.), *Beyond MIDI: The Handbook of Musical Codes* (Cambridge, MA: MIT Press, 1997), pp. 375–401.

Nevertheless, it is neither possible nor desirable to prevent technology from being used, not merely to assist with tasks that can already be done by humans, but to do entirely new things that were impossible without it. And there are large, well-established and flourishing communities of researchers, such as those who attend conferences such as ICMC (<http://www.computermusic.org/page/23>, accessed 21 April 2009), ISMIR (<http://www.ismir.net>) and NIME (<http://itp.nyu.edu/nime/2007/>, both accessed 21 April 2009), that actively seek out and extend the limits of what can be achieved in music with technology.

Closing remarks

One of the major themes and conclusions that emerged throughout the course of the Expert Seminar is that the traditional dichotomy between symbolic and audio music representations in music informatics is dissolving, with similar techniques being used on both types of data. It has become clear that representation systems for music must be able to cope, not just with notes, but also with the detailed structure of musical sounds, the composer's intent, and other higher-level structures such as streams, groups and chords. Furthermore, it must become possible to map transparently between representations at these different structural levels. On the other hand, it would be a mistake to attempt to develop universal representational systems without having specific test applications in mind.

There is also evidence that considerably more effort and interdisciplinary coordination need to be applied to the design of appropriate software interfaces and methods of visualizing music information. Technologically-naïve but musically sophisticated users should be able to access the full power of a system by means of a graded interface that can be customized for use by both beginning and advanced users. Representations should support a multiplicity of views on the data and allow for multiple methods to be applied. New web and database technologies should be exploited to produce multidimensional networked online archives containing both visual and audio digital musical materials.

It is also clear that important issues arise from the interdisciplinary nature of the field of computational musicology. There is a great need for increased transdisciplinary awareness: technologists need to be more in touch with what is required by music professionals and music professionals need to have a better understanding of what is technologically feasible. This suggests that training in relevant technology should be more central in music education, and professional users of ICT should be properly trained in its use. It also seems that, gradually, the 'lone-scholar' culture in musicological research should be replaced with a more collaborative culture like the one that is typical in scientific disciplines.

Finally, the Expert Seminar highlighted the debate that is ongoing about how best computing technology can transform musicological practice. In my view, this is not an issue that is worthy of debate: the way that the use of technology within musicology evolves is limited only by the imagination and courage of musicologists

and will be determined by what musicologists actually do with the technology. There seems little doubt that a more open-minded attitude and willingness to collaborate with experts in other fields will accelerate the development of ICT use within musicology in exciting new directions.

The chapters that follow explore these and other important issues in depth. This book will therefore provide a valuable resource to technologists, musicologists, musicians and music educators, facilitating the identification of worthwhile goals to be achieved using technology and effective interdisciplinary collaboration.